REMARKS

In the Office Action, claims 1-20 were rejected. All pending claims are believed to be clearly allowable. Reconsideration and allowance of all pending claims are requested.

Rejections Under 35 U.S.C. § 103(a)

Independent claims 1, 12 and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Emery (U.S. Patent 6,624,547, hereinafter "Emery") in view of Clifton et al. (U.S. Patent 5,731,645, hereinafter "Clifton"). Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. Applicants respectfully assert that the present invention, as recited in independent claims 1, 12 and 13 is patentable over Emery.

Independent claims 1 and 12:

Independent claims 1 and 12 are clearly distinguishable from the teachings of Emery and Clifton, alone or in combination. In particular, neither Emery nor Clifton teaches, discloses or suggests at least "a series of serially connected turns formed by litz wire having a plurality of strands", as recited in claim 1 or at least "a series of serially connected turns formed by litz wire having a plurality of strands", as recited in claim 12.

The references do not reasonably support a suggestion or motivation for the substitution proposed by the Examiner.

The Examiner's position is essentially that one skilled in the art would have been motivated to replace the conductor of Emery with litz wire as discussed in Clifton. Neither of the references supports that position.

Independent claims 1 and 12 require a particular conductor structure and the use of litz wire. The application makes clear that the inventors recognized that, in this particular conductor structure, AC heating can be minimized and additional benefits can be obtained by the use of litz wire. In particular, the application sets out that:

> The litz wire forming coil 210, as known in the art, includes a plurality of individual strands 230 including lightly insulated wires wound or twisted together in a pattern, in particular embodiments a uniform pattern. The strands are transposed in a specific configuration to reduce AC losses, as known in the art, The multi-strand configuration minimizes power losses otherwise encountered in a solid conductor due to what are commonly known as the "skin and proximity effects" and reduces high AC heating associated with eddy currents. Typically, as frequency requirements increase, the number of strands 230 is increased and the gauge size (or diameter) of the individual strands is decreased.
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> *See,* Application, paragraph 0025.

First, regarding Clifton, the Examiner relied upon the reference merely for its teachings regarding turns made of litz wire. Applicants do not deny that the reference generally discusses litz wire. Applicants also point out that litz wire, as acknowledged by the passage from the application discussed above, was clearly known prior to this invention. However, litz wire had never been used in the manner claimed. Certainly, nothing in Clifton would prompt its use in a winding of the type defined by claims 1 and 12.

Emery, on the other hand, adopts a completely different solution to a multi-conductor winding. Emery utilizes copper strands 22 in lieu of the litz wire. In Emery, increase in cooling effectiveness is provided by reducing the potential difference between

the cooling tubes 30 and copper strands 22, via capacitive coupling. According to the reference:

> An equivalent circuit showing the internal capacitance of a stator coil 20 is illustrated in FIG. 7. For example, with a 60 Hz or 50 Hz voltage (coil voltage) applied to the stator coil 20 between the metal coil strands 22, i.e., copper, and the conducting outer electrode of the coil 20, the applied AC voltage is distributed across the groundwall insulation and the tube to copper insulation. Part of the applied voltage is coupled to the vent tubes 30 through the distributed capacitance C3. The vent-tube 30-to-copper-strand insulation is then subject to the high voltage stress level which if high enough can lead to insulation failure. Insulation failure due to overvoltage can result in copper-to-vent-tube shorting. Once two or more shorts occur, excessive current can flow in the vent tubes 30. Excessive current in the vent tubes 30 can cause the vent tubes 30 to melt and reduce the cooling effectiveness. Complete coil failure can then follow due to overheating of the coil 30. To minimize the possibility of a copper-to-tube short, it is advantageous to reduce the potential difference between the cooling tubes 30 and copper strands 22.
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> An equivalent circuit of the cross-section of an inner cooled coil is shown in FIG. 8. With an AC voltage applied to the coil 30 between the copper strands 22 and the ground electrode, a portion of the AC voltage is coupled through the capacitance (C2) that exists between the top and bottom cooling tubes and the copper coil. This coupled voltage results in a large potential difference between the cooling tubes and the coil copper. The voltage drop across a capacitance (C1) is the voltage stress between the tube and copper strands (across the insulation). The magnitude of the voltage (VC2), depends on the relative values of the distributed capacitance (C1 and C2). The magnitude of potential (VC2) is equal to V1(XC2/(XC2+XC3)). The magnitude of the potential (VC2) can reach several hundred volts with coil rated voltage of V1. The insulation between the copper and vent tubes will fail if VC2 exceeds the dielectric strength of the insulation. Once voltage breakdown occurs, then it is possible to have the copper short to the vent tube.
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> Reducing the coupled value of V2 can be obtained by reducing the value of the impedance associated with XC2 and this impedance can be reduced by placing a low impedance (resistance) across the C2 coupling capacitor. A low impedance connected from the coil copper to each vent tube will reduce

> the magnitude of the voltage (VC2) distributed between the vent tubes and copper.
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> Emery, column 3, line 37 – column 4, line 14.

This multi-strand approach, then, is specifically adopted to provide capacitive coupling and thereby to reduce potential differences between the coils and the vent tubes. Applicants submit that there is no reasonable basis for believing that litz wire would or even could capacitively couple in this manner.

Moreover, any gain in flexibility or current-carrying capacity (e.g., due to skin effect) obtainable with litz wire would presumably be provided by the multiple strands taught by Emery. As such, there would be no reason whatsoever for making the substitution of Clifton's litz wire in Emery's windings.

Finally, Emery does not disclose high frequency applications, which benefit from the use of litz wire or a series of serially connected turns for reducing eddy currents via skin effect, as suggested by the Applicants. One skilled in the art would just as readily conclude that Emery's multi-strand windings are effective at the frequencies to which they are submitted. At the very least, neither Emery nor Clifton provide any reasonable basis for the substitution. According to MPEP 2143.01, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. That is not the case here.

In summary, there is no rational reason to combine the teachings of Emery and Clifton, because one skilled in the art would not use litz wire or a series of serially connected turns instead of copper strands 22 to increase cooling effectiveness, via capacitive coupling. Furthermore, replacing copper strands 22 with litz wire may change the operation of the system disclosed in Emery, because capacitive coupling may not be

achieved in such a case. Therefore, one skilled in the art would not be motivated to use the litz wire instead of copper strands 22.

Accordingly, Applicants respectfully submit that independent claims 1 and 12 and the claims depending therefrom are allowable and respectfully request the Examiner to reconsider the rejection of the claims.

Independent Claim 13:

In the Office Action, the Examiner rejected claim 13 in view of Emery and Clifton. The Examiner observed that Emery does not disclose serially connected turns, but argued that Emery does provide teachings for the remainder of the recitations of claim 13. The Examiner relied on Clifton for teaching serially connected turns.

Applicants observe that, here again, there is no reasonable basis for the combination of Emery and Clifton. In particular, any such combination would essentially be counter to the reasonable interpretation and solutions taught by both references. More particularly, Emery teaches a technique for cooling a rotating machine by the use of vent tubes. Clifton, quite the contrary, teaches the reduction in heat generation in a machine by the use of flywheels.

The arrangement recited in claim 13 is intended to remove heat in two manners. As pointed out in paragraph 28 of the application, a majority of the heat transferred from the turns 211-218 occurs by way of heat flow along the individual strands 230 in a longitudinal direction. That is, heat flows along the longitudinal axis of the individual strands. Heat also is transferred from the respective individual strands 230 by formation of the cooling tubes.

Emery does not disclose serially connected turns, and clearly relies only upon the vent tubes 30 for removal of heat. No mention whatsoever can be found in Emery for any other mode of heat transfer.

Clifton, on the other hand, discusses minimization of heat generation, and not heat transfer either along individual strands or from individual strands to cooling tubes. Clifton adopts an entirely different approach to management of heat by avoiding heat generation:

> Various features of the present invention, particularly including the smooth laminated ring without armature coil slots or holes, greatly reduce these constant standby losses. Nevertheless, if a very large amount of energy is required, it may be preferable to provide a multi-flywheel system in which only one flywheel is maintained in a fully or nearly fully energized state. The energized flywheel must be able to produce enough power to account for the power requirements during the time the other flywheels are increased to their fully energized states (i.e., full operating flux is being produced). In this case, core losses and field coil heating may be minimized while still providing for the immediate output of the required power.

See, Clifton, column 11, lines 40-52.

Clearly, the references cannot be reasonably combined. That is, there would be no reasonable expectation that vent tubes of the type taught by Emery would have any purpose in the Clifton machine, where heat generation is minimized by the use of flywheels. Conversely, upon reading Emery, one skilled in the art would not be led to make the replacement of the coils of Emery with those of Clifton for heat removal purposes. Indeed, such replacement would entirely change the structure and, it is believed, would change the electrical nature of the operation of the Emery generator.

Because the teaching of Emery and Clifton cannot be reasonably combined, claim 13 is clearly allowable. That is, Emery and Clifton cannot be combined to render obvious the use of serially connected AC bars that include cooling tubes through which a cooling

medium flows. Reconsideration and allowance of claim 13 and of the claims depending therefrom are therefore respectfully requested.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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